



GREEN SOLUTIONS

ENVIRONMENTAL CONSULTING

Clark County 2008 Waste Stream Analysis



October 2008

2008 WASTE STREAM ANALYSIS

Prepared for:

Clark County
Department of Public Works,
Solid Waste Division

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EXECUTIVE SUMMARY

INTRODUCTION

This study examined the quantity and composition of solid waste (garbage) disposed by homes and businesses in Clark County from May 2007 through April 2008 at the two in-county transfer stations. The goals of this study were to:

- provide data for evaluating current waste diversion programs and for planning future programs.
- provide data that can be used to evaluate the performance of waste diversion activities at the transfer stations.
- satisfy the County's contractual obligation to periodically conduct a comprehensive analysis of the municipal solid waste stream.

This waste composition study was conducted by the environmental consulting firm of Green Solutions, with assistance from Environmental Practices, LLC. Waste Connections provided substantial assistance by surveying self-haul customers, arranging loads, pulling samples from loads, and providing data. County solid waste staff and others also assisted with this project.

RESULTS

Waste Quantities

The quantity (tonnage) of solid waste disposed by each type of generator was determined through existing transaction records and additional data provided by Waste Connections, the City of Camas, and others. Table E-1 shows the results of the waste quantity analysis.

Waste Composition

The composition of the County's solid waste stream was determined by randomly selecting and sorting samples of waste from loads delivered to the West Van Materials Recovery Center and the Central Transfer and Recycling Center. The waste composition results are illustrated in Figure E-1. The results shown in Figure E-1 are a weighted annual average for all sources.

CONCLUSIONS

Waste Quantities

A number of observations and conclusions can be made by examining the waste quantity data:

- **Residential Self-Haul:** the Residential Self-Haul waste stream is made up of numerous small loads delivered to the transfer stations in cars, pickup trucks and similar vehicles. It is

TABLE E-1
ANNUAL QUANTITIES OF DISPOSED WASTES

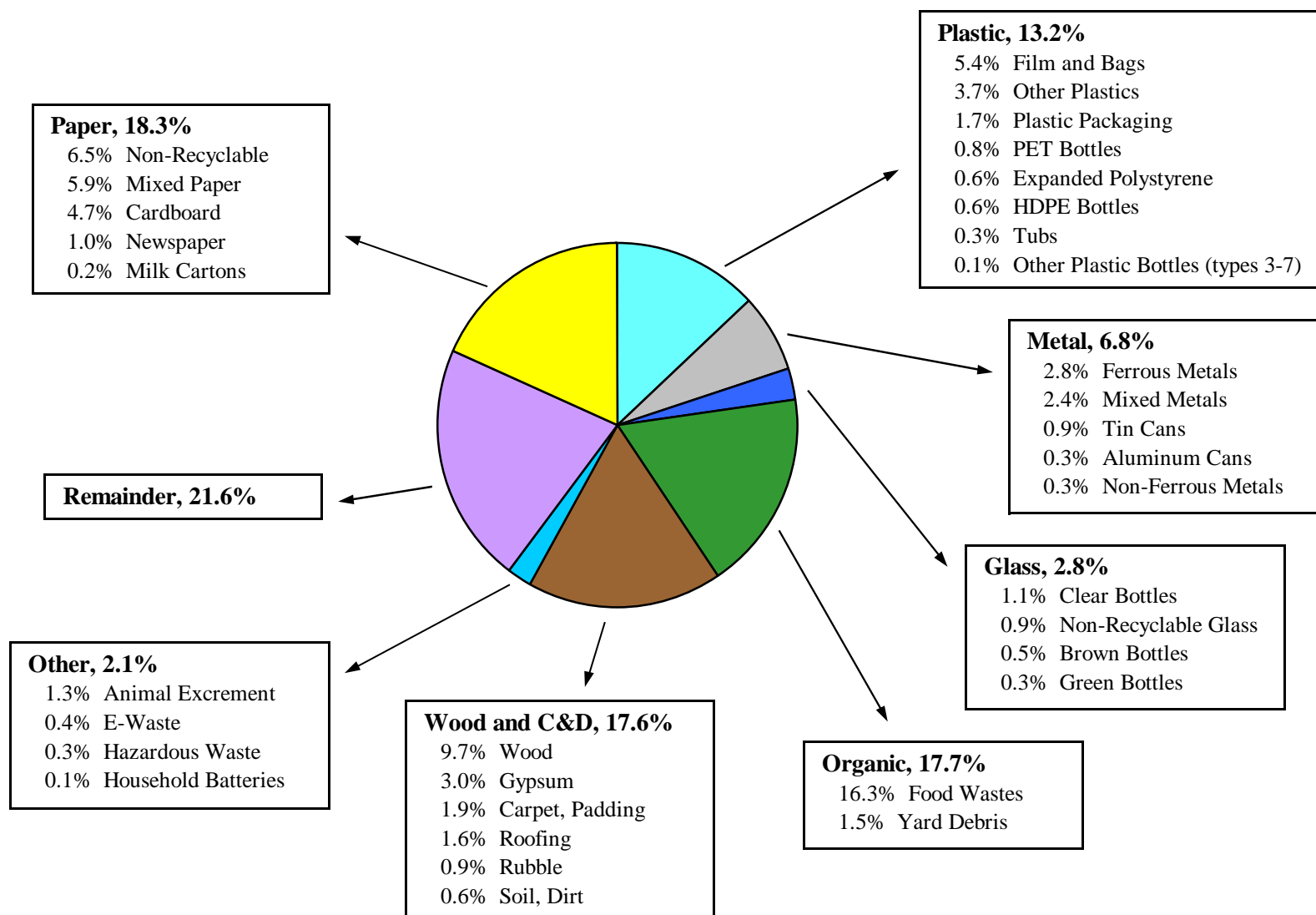
Type of Waste Generator	Annual Amounts	
	Tons	Percent
Residential Self-Haul	19,780	7.0
Non-Residential Self-Haul	<u>38,220</u>	<u>13.6</u>
Self-Haul Subtotal	58,000	20.6
Single-Family	85,880	30.5
Multi-Family	14,160	5.0
Commercial	59,090	21.0
Commercial Compactor	<u>64,760</u>	<u>23.0</u>
Garbage Truck Subtotal	223,900	79.4
Total	281,900	100.0

Note: Quantities shown are for the period May 1, 2007 through April 30, 2008.

an important service to allow people to haul their own waste to the transfer stations, but this is also the least efficient method of garbage collection. While this source contributes only 7.0% of the county's total waste stream, this type of generator is responsible for 54% of the traffic at the transfer stations. Self-haul loads average about 300 pounds per vehicle, compared to an average of 9,000 to 14,000 pounds per load for municipal and private garbage trucks, but frequently take as long or longer to unload as garbage trucks.

- **Non-Residential Self-Haul:** this type of generator brings in almost twice as much waste (13.6%) as Residential Self-Haul generators, and it does so with fewer trips and larger loads. Based on transaction records for the same period as this study, Non-Residential Self-Haul loads represent slightly less than one-quarter (23.3%) of the vehicle trips through the transfer stations and deliver an average of 1,347 pounds per vehicle.
- **Single-Family:** Single-Family wastes contribute almost one-third (30.5%) of the total tonnage of the County's waste stream. This figure does not include Residential Self-Haul quantities, which is also almost entirely from single-family homes.
- **Multi-Family:** this study shows that 14,160 tons per year, or 5.0%, of Clark County's waste stream is from Multi-Family units. Previous studies showed more in 2003 (40,100 tons or 17.2% of the waste stream) and in 1999 (21,400 tons and 9.9%). The current figure appears consistent with other current data, but further study should be done to determine the correct amount of waste generated by multi-family units.

**FIGURE E-1
WASTE COMPOSITION RESULTS
CLARK COUNTY WASTE COMPOSITION STUDY**



Note: All figures are percent by weight.

- **Commercial and Commercial Compactors:** the Commercial and Commercial Compactor waste streams together make up almost half (45.0%) of the county's waste stream, with almost equal amounts collected by garbage trucks servicing dumpsters (21.0%) versus single-source roll-off's and compactors (23.0%).

Waste Composition

There are distinct differences in the waste streams disposed by the different types of waste generators, as can be seen in several of the tables and figures in this report. For each of the generators, a few noteworthy conclusions can be drawn:

- **Single-Family:** the largest material in this waste stream is food waste (21.8% by weight), which is disposed at almost three times the quantity as the next largest materials, mixed waste paper (7.4%) and non-recyclable paper (7.3%). There are also significant quantities of film and bags (6.9%) and animal excrement ("kitty litter") at 3.0%.

The Single-Family waste stream contains 20.9% of the materials currently collected through the curbside recycling program (including yard debris).
- **Multi-Family:** Multi-Family wastes also contain a lot of food waste (15.6%), with again mixed waste paper (10.3%) and non-recyclable paper (5.3%) being the next two highest materials. There are also significant quantities of film and bags (4.8%), cardboard (4.7%), and mixed metals (2.9%).
- **Residential Self-Haul:** self-haul loads from residential sources have more wood, construction debris and metal than other residential sources, and less "regular" household trash (paper, plastic and food waste), reflecting the activities such as remodeling and other special projects that are often the source of self-haul waste. Wood is the material present in the single largest quantity, at 13.8%, followed by food waste (9.7%), mixed metals (7.4%), mixed waste paper (5.2%), cardboard (4.1%), and other plastics (3.7%).
- **Non-Residential Self-Haul:** like self-haul waste from residential sources, Non-Residential Self-Haul loads are often the result of construction activities or other special projects. The large amount of wood (22.2%) and other construction waste (31.5%) clearly shows the influence of construction activities on this waste stream. Although this waste generator contributes only 13.6% of the County's total waste stream, Non-Residential Self-Haul customers are disposing of 31% of the wood and 54% of the C&D materials.
- **Commercial:** waste from this source also contains a large amount of food waste (24.3%), followed by non-recyclable paper (9.1%), mixed waste paper (8.3%), plastic film and bags (7.2%), and cardboard (5.4%).
- **Commercial Compactors:** waste from this source contains less food waste (12.9%) than the other commercial category. Wood is the largest category (20.8%), followed by cardboard (7.4%), non-recyclable paper (7.6%), plastic film and bags (5.5%), and other plastics (5.4%).

SECTION I INTRODUCTION

A. SCOPE AND OBJECTIVES

This study examined the quantity and composition of solid waste (garbage) disposed by homes and businesses in Clark County from May 2007 through April 2008 at the two in-county transfer stations. The goals of this study were to:

- provide data on the composition and quantity of disposed materials, for evaluating current waste diversion programs and for planning future programs.
- provide data that can be used in the future to evaluate the performance of waste diversion activities at the Central Transfer Recycling Center (CTR) and West Van Materials Recovery Center (West Van).
- address specific concerns, such as the impact of construction and demolition wastes brought in by contractors.
- satisfy the County's contractual obligation to periodically conduct a comprehensive analysis of the municipal solid waste stream.

This waste composition study was conducted by the environmental consulting firm of Green Solutions, with assistance from Environmental Practices, LLC. Waste Connections provided substantial assistance by surveying self-haul customers, arranging loads, pulling samples from loads, and providing data. County solid waste staff and others also assisted with this project.

B. BACKGROUND

The Central Transfer and Recycling Center and the West Van Materials Recovery Center are operated by Columbia Resource Company. Each of these facilities include:

- a waste transfer operation, where waste is compacted into transfer trailers and transported by barge to the Finley Buttes landfill in Oregon;
- an extensive recycling drop-off center;
- a yard debris collection and transfer operation;
- a household hazardous waste collection facility.

In addition, West Van offers a buy-back opportunity for some recyclables, and a processing line for recyclable materials collected from residential and commercial sources. This study examined only the wastes brought to the first of these, the transfer operation.

SECTION II RESULTS

A. OVERVIEW

This study examined mixed municipal solid waste brought for disposal to the West Van Materials Recovery Center (West Van) and Central Transfer and Recycling Center (CTR). “Mixed municipal solid waste” is the term commonly used for general residential and commercial wastes, including the waste collected by garbage haulers and the waste delivered to transfer or disposal sites by the waste generators themselves (self-haul).

Types of Waste Generators

The design of the sampling and data collection procedures for this study allowed information to be provided on the quantity and composition of waste disposed by different sources (“waste generators”) as well as the County’s overall waste stream. For this purpose, the County’s waste stream was classified into six groups according to the source and method of delivery. The six groups are:

- **Residential Self-Haul:** this is waste that is brought in by homeowners and renters who generated the load of waste, although in some cases they may be assisting a family member, neighbor or acquaintance who actually generated the waste. This category also includes landlords hauling their tenants’ waste. This type of waste is typically transported to the disposal site using a car or pickup truck, and there is a distinct pattern in the timing of such deliveries. Most of the residential self-haul waste is brought to the disposal site on weekends or in the evenings (i.e., at times other than regular daytime work hours).
- **Non-Residential Self-Haul:** this waste is from businesses or contractors, and is typically brought in by an employee of that business. The pattern in the delivery of this waste tends to be the opposite of Residential Self-Haul wastes, occurring primarily during regular work hours, and is typically brought in with larger vehicles (dump trucks, pickup trucks with trailers, and other trucks). A substantial amount of this waste stream consists of loads of construction and demolition wastes brought in by construction contractors.
- **Single-Family:** by definition, this waste is brought in by garbage haulers (including municipal collectors), and is collected from single-family homes. This waste is typically bagged before collection, relatively heterogeneous (consisting of small pieces of many different types of materials), and is delivered to the disposal site most often between mid-morning and mid-afternoon Monday through Friday.
- **Multi-Family:** by definition, this waste is brought in by garbage haulers or municipal collectors from apartment buildings. This waste is often bagged before collection, relatively heterogeneous (consisting of small pieces of many different types of materials), and is

delivered to the disposal site most often between early morning and mid-afternoon Monday through Friday. Most Multi-Family waste is mixed with Commercial waste when collected because both types of customers use dumpsters for garbage collection and are collected on routes served by front-loading garbage trucks. Larger multi-family sites often use a compactor for their wastes, in which case these loads are separately brought to the disposal sites using the same equipment that services Commercial Compactors.

- **Commercial:** for this study, “commercial” waste is defined to include wastes from businesses (commercial and industrial) and institutions (schools, hospitals, government offices, etc.). These wastes are typically collected using front-loading garbage trucks that empty dumpsters and are usually delivered early morning through mid-afternoon Monday through Friday.
- **Commercial Compactors:** this is waste that is brought to one of the transfer stations from businesses, industries or institutions, delivered by a municipal collection crew or private garbage hauler in a stationary compactor or roll-off container (dropbox). Since these wastes are in large containers that are brought directly to one of the transfer stations to be emptied, the waste is only from the one business or institution where the compactor or roll-off was located (unless other types of wastes are thrown in at the point of generation, which sometimes occurs).

Construction and demolition (C&D) wastes and other special wastes are included in the above categories as appropriate for the source and delivery method. This waste is often delivered by employees of the construction company and so is included with Non-Residential Self-Haul waste, but C&D waste is also delivered by homeowners and landlords (i.e., Residential Self-Haul waste), or by waste haulers from construction sites (Commercial waste), or even by waste haulers delivering roll-off containers from do-it-yourself home remodeling projects (Single-Family waste).

B. WASTE QUANTITIES

The quantity (tonnage) of solid waste disposed by each type of generator was determined through existing transaction records and additional data provided by Waste Connections and others. The additional data provided by Waste Connections included:

- a survey of self-haul customers by scalehouse personnel. Data collected by this survey determined the breakdown of cash customers into residential and non-residential sources, and also determined how much waste was delivered by sources from the City of Vancouver versus the rest of the county.
- data from their customer records as to how much Single-Family, Multi-Family, and Commercial wastes were included in deliveries by their collection trucks to the transfer stations.

The City of Camas also provided the information needed to allocate their waste deliveries into Single-Family, Multi-Family, and Commercial categories. Annual tonnage data for charge accounts was analyzed by the consultants to allocate those tonnages between Residential Self-Haul and Non-Residential Self-Haul. Thus, tonnages for the four major types of customers (cash, charge accounts, private hauler, and municipal hauler) were allocated to the six generator types employed in this study. In all cases, the data used was for a one-year period coinciding with the period of this study (May 1, 2007 through April 30, 2008), and quarterly data was based on a one-month period coinciding with the timing of the waste sorting fieldwork. Table 1 shows the results of the waste quantity analysis.

One way to look at this data is in terms of waste generation rates. Comparing Clark County's waste tonnages for the study period (281,900 tons) to recent population estimates (415,000 people in 2007 according to the Washington Office of Financial Management), leads to a per capita waste generation rate of 0.68 tons per person per year or 3.72 pounds per person per day.

Waste quantity data can also be applied separately to residential and non-residential generators. For Clark County's estimated 2007 population (415,000 people) and looking only at the residential waste quantities (119,820 tons per year), the residential waste generation is 0.29 tons per person per year or 1.58 pounds per person per day. For non-residential waste quantities (162,080 tons per year) and an estimated 134,000 workers (from the U.S. Department of Labor for the third quarter of 2007), the non-residential waste generation rate is 1.21 tons per employee per year or 6.63 pounds per employee per day (or 9.33 pounds per employee per day on the basis of a five-day work week).

The self-haul survey conducted by scalehouse personnel collected data on the geographic source of the waste (the City of Vancouver versus the rest of the County) in addition to determining whether it was from residential or non-residential sources. This data shows that:

- 20% (by weight) of the loads brought in by cash customers were residential wastes from homes and apartments in Vancouver, versus 23% from residential sources in the rest of the county.
- 24% (by weight) of the loads brought in by cash customers were non-residential wastes from businesses in Vancouver, versus 33% from non-residential sources in the rest of the county.
- overall, 44% of the cash customers were from Vancouver.

These figures do not include self-hauled wastes brought in by customers with accounts.

C. WASTE COMPOSITION

The composition of the County's solid waste stream was determined by randomly selecting and sorting samples of waste from loads delivered to West Van and CTR. Sampling was conducted Tuesday through Saturday for three quarters (July 2007, January 2008, and April 2008), and Sunday through Thursday one quarter (October 2007). Each sample was sorted into 35 distinct

TABLE 1
QUANTITIES OF DISPOSED WASTES

Type of Waste Generator	July 2007		October 2007		January 2008		April 2008		Annual Amounts	
	Tons	Percent	Tons	Percent	Tons	Percent	Tons	Percent	Tons	Percent
Residential Self-Haul	2,210	8.3	1,580	5.7	1,150	4.7	1,910	7.8	19,780	7.0
Non-Residential Self-Haul	<u>5,690</u>	<u>21.3</u>	<u>5,850</u>	<u>21.2</u>	<u>4,530</u>	<u>18.3</u>	<u>4,530</u>	<u>18.5</u>	<u>38,220</u>	<u>13.6</u>
Self-Haul Subtotal	7,900	29.5	7,430	27.0	5,680	23.0	6,440	26.3	58,000	20.6
Single-Family	7,540	28.2	7,460	27.1	7,530	30.4	6,920	28.3	85,880	30.5
Multi-Family	1,170	4.4	1,290	4.7	1,180	4.8	1,130	4.6	14,160	5.0
Commercial	4,410	16.5	5,350	19.4	5,070	20.5	4,840	19.8	59,090	21.0
Commercial Compactor	<u>5,730</u>	<u>21.4</u>	<u>6,030</u>	<u>21.9</u>	<u>5,290</u>	<u>21.4</u>	<u>5,130</u>	<u>21.0</u>	<u>64,760</u>	<u>23.0</u>
Garbage Truck Subtotal	18,850	70.5	20,130	73.0	19,060	77.0	18,030	73.7	223,900	79.4
Totals	26,750	100.0	27,550	100.0	24,740	100.0	24,470	100.0	281,900	100.0

categories of materials. Notes were also recorded on the field data form as to the specific source of the loads for Commercial Compactors and Non-Residential Self-Haul. The Glossary provides additional detail on the definitions used for this study for the types of generators and material categories.

Sampling Methods

The composition of the County's mixed municipal waste stream was determined by randomly selecting and sorting a total of 243 samples of waste. These samples were allocated between the types of generators based on the need to examine certain types in greater detail. A greater number of samples were taken for the waste streams that are considered inherently more variable (the two self-haul waste streams, Commercial wastes and Commercial Compactor wastes), and fewer of the samples were allocated to the waste streams that are typically less variable (Single-Family and Multi-Family). The Single-Family samples were divided between City of Vancouver and other Clark County routes based on population data showing that about one-third of the single-family homes are in Vancouver. The number of samples taken each quarter is shown in Table 2.

TABLE 2
NUMBER OF SAMPLES BY TYPE OF GENERATOR

Type of Waste Generator	July 2007	October 2007	January 2008	April 2008	Totals	
					Number	Percent
Residential Self-Haul	11	11	11	12	45	19%
Non-Residential Self-Haul	13	11	11	11	46	19%
Single-Family	8	8	7	8	31	13%
Multi-Family	6	6	6	6	24	10%
Commercial	10	11	11	13	45	19%
Commercial Compactors	13	14	14	11	52	21%
Totals	61	61	60	61	243	100%

Waste Composition Results

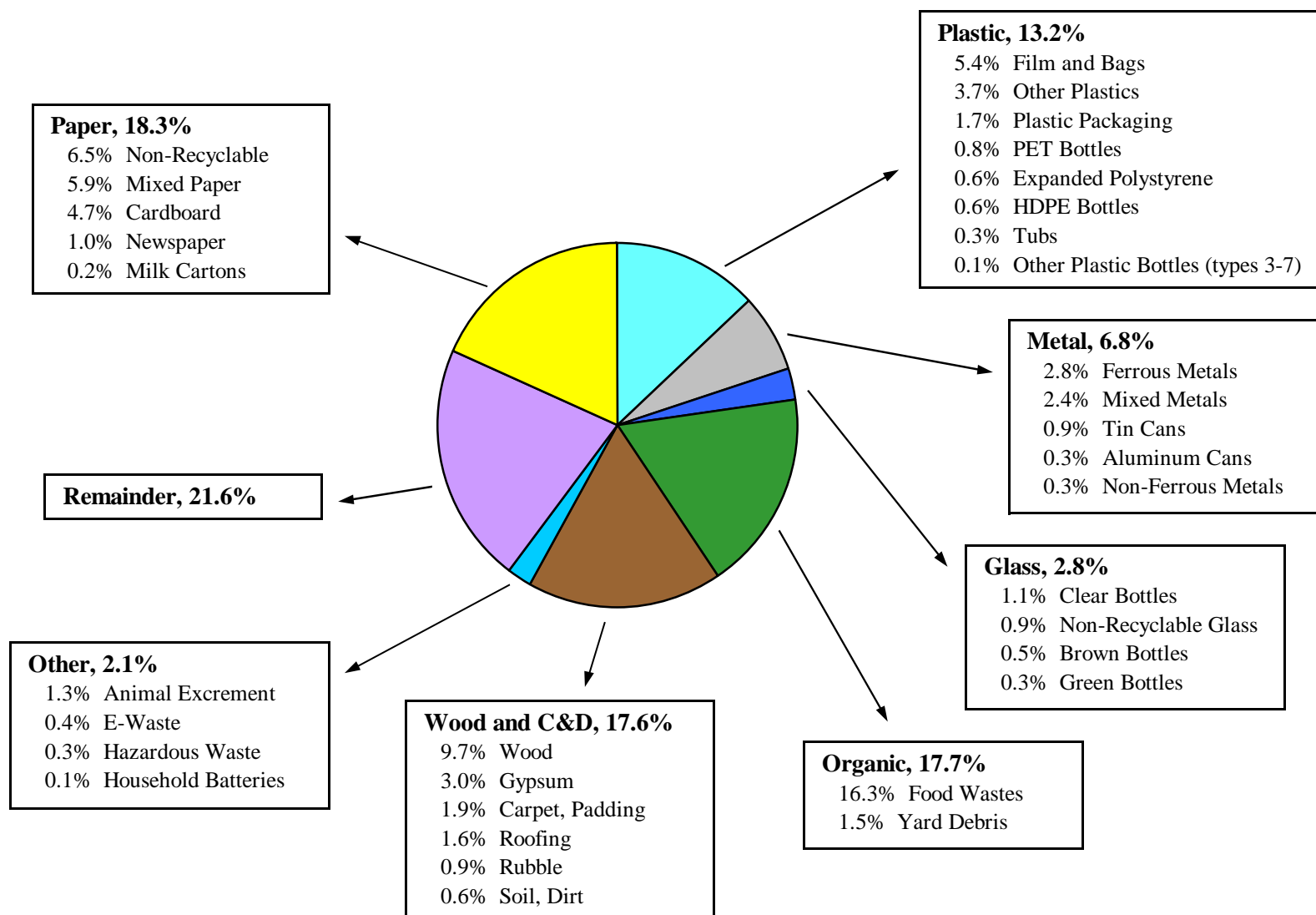
Table 3 shows the annual average waste composition figures for each generator and for the entire County as a whole. The results for the entire County are also illustrated in Figure 1.

As can be seen in Table 3, there are substantial differences in the composition of wastes from the different sources. These differences can be explained by the different activities that created the wastes. Single-Family waste, for instance, is influenced by the activities associated with living in and maintaining a home. Residential Self-Haul waste contains typical household garbage but also contains some construction debris and other materials from the special projects that often motivate people to make a special trip to disposal facilities.

TABLE 3
WASTE COMPOSITION RESULTS
CLARK COUNTY WASTE COMPOSITION STUDY

		Single- <u>Family</u>	Multi- <u>Family</u>	Residential <u>Self-Haul</u>	Non-Res. <u>Self-Haul</u>	<u>Commercial</u>	Commercial <u>Compactors</u>	Average for <u>Entire County</u>
PAPER	Newspaper	1.33%	2.44%	0.44%	0.28%	1.14%	0.54%	0.96%
	Cardboard	1.68%	4.74%	4.11%	6.31%	5.40%	7.44%	4.74%
	Mixed Waste Paper	7.42%	10.34%	5.24%	2.06%	8.28%	2.98%	5.85%
	Milk Cartons, Other	0.34%	0.26%	0.06%	0.03%	0.41%	0.13%	0.24%
	Non-Recyclable Paper	7.32%	5.32%	2.10%	1.16%	9.14%	7.64%	6.47%
	Paper Subtotal	18.08%	23.11%	11.95%	9.84%	24.37%	18.73%	18.25%
PLASTIC	PET Bottles	1.29%	1.54%	0.61%	0.16%	1.01%	0.38%	0.83%
	HDPE Bottles	0.70%	1.21%	0.37%	0.08%	0.93%	0.25%	0.56%
	Bottles 3-7	0.17%	0.07%	0.09%	0.01%	0.08%	0.04%	0.09%
	Tubs	0.64%	0.48%	0.14%	0.01%	0.28%	0.10%	0.31%
	Plastic Packaging	2.22%	1.90%	1.07%	0.46%	2.01%	1.55%	1.68%
	Film and Bags	6.85%	4.83%	1.99%	1.27%	7.18%	5.48%	5.40%
	Other Plastics	2.16%	2.50%	3.66%	6.68%	2.29%	5.36%	3.66%
	Expanded Polystyrene	0.75%	0.58%	0.45%	0.26%	0.75%	0.70%	0.64%
	Plastic Subtotal	14.77%	13.12%	8.36%	8.95%	14.54%	13.86%	13.19%
METAL	Aluminum Cans	0.54%	0.80%	0.23%	0.07%	0.38%	0.11%	0.34%
	Tin Cans	1.31%	1.49%	0.68%	0.16%	1.24%	0.30%	0.87%
	Ferrous Metals	1.67%	0.95%	2.60%	5.22%	3.37%	2.71%	2.78%
	Non-Ferrous Metals	0.37%	0.25%	1.39%	0.18%	0.22%	0.22%	0.34%
	Mixed Metals	1.74%	2.93%	7.38%	3.32%	2.20%	1.44%	2.44%
	Metal Subtotal	5.64%	6.43%	12.29%	8.95%	7.41%	4.78%	6.77%
ORGANIC	Food Waste	21.82%	15.57%	9.72%	0.67%	24.28%	12.91%	16.26%
	Yard Debris	1.25%	1.67%	3.32%	0.41%	1.93%	1.29%	1.45%
	Organic Subtotal	23.07%	17.24%	13.05%	1.08%	26.21%	14.20%	17.71%
GLASS	Clear Bottles	1.45%	3.01%	1.33%	0.14%	1.21%	0.37%	1.05%
	Brown Bottles	0.76%	1.24%	0.72%	0.04%	0.56%	0.18%	0.51%
	Green Bottles	0.43%	0.68%	0.23%	0.02%	0.41%	0.16%	0.31%
	Non-Recyclable Glass	0.56%	0.41%	3.28%	1.00%	0.17%	1.42%	0.92%
	Glass Subtotal	3.21%	5.34%	5.56%	1.21%	2.35%	2.13%	2.78%
WOOD and C&D	Wood	0.83%	1.33%	13.75%	22.21%	3.01%	20.76%	9.69%
	Gypsum	0.11%	0.20%	3.05%	17.26%	0.03%	1.59%	2.97%
	Rubble	0.58%	0.18%	2.28%	2.77%	0.35%	0.28%	0.86%
	Roofing	0.10%	0.05%	0.70%	6.01%	0.04%	2.96%	1.59%
	Carpet, Padding	0.40%	1.95%	4.08%	5.45%	0.74%	2.04%	1.87%
	Soil, Dirt	1.28%	0.23%	0.07%	0.01%	0.00%	0.95%	0.63%
	Wood, C&D Subtotal	3.31%	3.93%	23.92%	53.70%	4.16%	28.57%	17.60%
OTHER WASTES	Hazardous/Special	0.37%	0.10%	0.85%	0.17%	0.28%	0.15%	0.29%
	Household Batteries	0.17%	0.13%	0.05%	0.01%	0.04%	0.03%	0.08%
	Animal Excrement	2.99%	1.97%	2.63%	0.00%	0.54%	0.00%	1.31%
	E-Waste	0.04%	0.06%	0.00%	0.00%	0.52%	1.33%	0.43%
	Other Subtotal	3.56%	2.27%	3.54%	0.18%	1.37%	1.51%	2.10%
REMAINDER	Garbage and Other	28.36%	28.57%	21.34%	16.10%	19.59%	16.21%	21.58%
	TOTAL	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

FIGURE 1
WASTE COMPOSITION RESULTS
CLARK COUNTY WASTE COMPOSITION STUDY

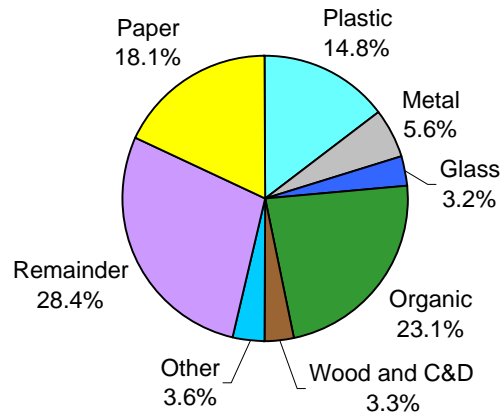


Note: All figures are percent by weight.

The Commercial waste stream in Clark County is dominated by various manufacturing and administrative activities, while the Non-Residential Self-Haul waste stream is dominated by construction activities. A business or institution will sometimes choose to haul their own waste, in which case the waste will not differ greatly from the waste that would have been collected by garbage haulers (Commercial waste), but Non-Residential Self-Haul wastes in many cases are from construction projects. Ample evidence of the contribution of construction activities to this waste stream is provided by the fact that over half of the Non-Residential Self-Haul waste stream is comprised of wood waste (22.2%) and other construction and demolition (C&D) waste (31.5%).

The waste composition results for each generator are illustrated in Figures 2 through 7.

FIGURE 2
SINGLE - FAMILY WASTE
CLARK COUNTY WASTE COMPOSITION STUDY

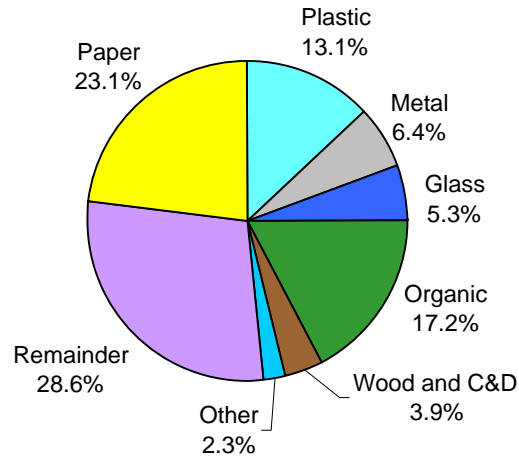


SUMMARY OF WASTE COMPOSITION RESULTS:

PAPER	Newspaper	1.3%	ORGANIC	Food Waste	21.8%
	Cardboard	1.7%		Yard Debris	<u>1.2%</u>
	Mixed Waste Paper	7.4%		Organic Subtotal	23.1%
	Milk Cartons, Other	0.3%	GLASS	Clear Bottles	1.5%
	Non-Recyclable Paper	<u>7.3%</u>		Brown Bottles	0.8%
PLASTIC	Paper Subtotal	18.1%		Green Bottles	0.4%
	PET Bottles	1.3%		Non-Recyclable Glass	<u>0.6%</u>
	HDPE Bottles	0.7%		Glass Subtotal	3.2%
	Bottles 3-7	0.2%	WOOD C&D	Wood	0.8%
	Tubs	0.6%		Gypsum	0.1%
	Plastic Packaging	2.2%		Rubble	0.6%
	Film and Bags	6.8%		Roofing	0.1%
	Other Plastics	2.2%		Carpet, Padding	0.4%
	Expanded Polystyrene	<u>0.8%</u>		Soil, Dirt	<u>1.3%</u>
	Plastic Subtotal	14.8%		Wood, C&D Subtotal	3.3%
METAL	Aluminum Cans	0.5%	OTHER	Hazardous/Special	0.4%
	Tin Cans	1.3%		Household Batteries	0.2%
	Ferrous Metals	1.7%		Animal Excrement	3.0%
	Non-Ferrous Metals	0.4%		E-Waste	<u>0.0%</u>
	Mixed Metals	<u>1.7%</u>		Other Subtotal	3.6%
	Metal Subtotal	5.6%	REMAINDER	Garbage and Other	28.4%

Notes: All figures are percent by weight.

**FIGURE 3
MULTI - FAMILY WASTE
CLARK COUNTY WASTE COMPOSITION STUDY**

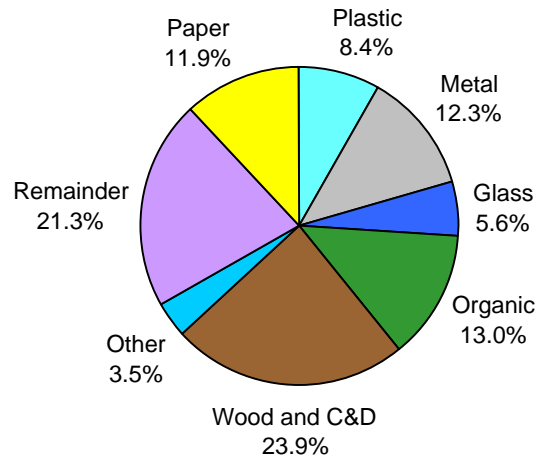


SUMMARY OF WASTE COMPOSITION RESULTS:

PAPER	Newspaper	2.4%	ORGANIC	Food Waste	15.6%
	Cardboard	4.7%		Yard Debris	<u>1.7%</u>
	Mixed Waste Paper	10.3%	GLASS	Organic Subtotal	17.2%
	Milk Cartons, Other	0.3%		Clear Bottles	3.0%
	Non-Recyclable Paper	<u>5.3%</u>		Brown Bottles	1.2%
PLASTIC	Paper Subtotal	23.1%		Green Bottles	0.7%
	PET Bottles	1.5%		Non-Recyclable Glass	<u>0.4%</u>
	HDPE Bottles	1.2%		Glass Subtotal	5.3%
	Bottles 3-7	0.1%	WOOD C&D	Wood	1.3%
	Tubs	0.5%		Gypsum	0.2%
	Plastic Packaging	1.9%		Rubble	0.2%
	Film and Bags	4.8%		Roofing	0.0%
	Other Plastics	2.5%		Carpet, Padding	1.9%
	Expanded Polystyrene	<u>0.6%</u>		Soil, Dirt	<u>0.2%</u>
	Plastic Subtotal	13.1%		Wood, C&D Subtotal	3.9%
METAL	Aluminum Cans	0.8%	OTHER	Hazardous/Special	0.1%
	Tin Cans	1.5%		Household Batteries	0.1%
	Ferrous Metals	1.0%		Animal Excrement	2.0%
	Non-Ferrous Metals	0.3%		E-Waste	<u>0.1%</u>
	Mixed Metals	<u>2.9%</u>		Other Subtotal	2.3%
	Metal Subtotal	6.4%	REMAINDER	Garbage and Other	28.6%

Notes: All figures are percent by weight.

FIGURE 4
RESIDENTIAL SELF - HAUL WASTE
CLARK COUNTY WASTE COMPOSITION STUDY

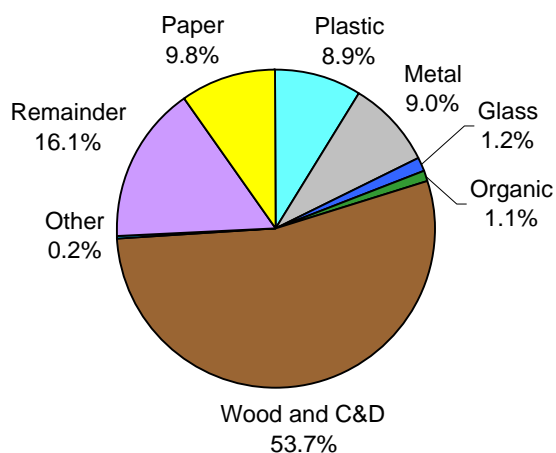


SUMMARY OF WASTE COMPOSITION RESULTS:

PAPER	Newspaper	0.4%	ORGANIC	Food Waste	9.7%
	Cardboard	4.1%		Yard Debris	<u>3.3%</u>
	Mixed Waste Paper	5.2%		Organic Subtotal	13.0%
	Milk Cartons, Other	0.1%	GLASS	Clear Bottles	1.3%
	Non-Recyclable Paper	<u>2.1%</u>		Brown Bottles	0.7%
PLASTIC	Paper Subtotal	11.9%		Green Bottles	0.2%
	PET Bottles	0.6%		Non-Recyclable Glass	<u>3.3%</u>
	HDPE Bottles	0.4%		Glass Subtotal	5.6%
	Bottles 3-7	0.1%	WOOD C&D	Wood	13.7%
	Tubs	0.1%		Gypsum	3.0%
	Plastic Packaging	1.1%		Rubble	2.3%
	Film and Bags	2.0%		Roofing	0.7%
	Other Plastics	3.7%		Carpet, Padding	4.1%
	Expanded Polystyrene	<u>0.4%</u>		Soil, Dirt	<u>0.1%</u>
	Plastic Subtotal	8.4%		Wood, C&D Subtotal	23.9%
METAL	Aluminum Cans	0.2%	OTHER	Hazardous/Special	0.8%
	Tin Cans	0.7%		Household Batteries	0.1%
	Ferrous Metals	2.6%		Animal Excrement	2.6%
	Non-Ferrous Metals	1.4%		E-Waste	<u>0.0%</u>
	Mixed Metals	<u>7.4%</u>		Other Subtotal	3.5%
	Metal Subtotal	12.3%	REMAINDER	Garbage and Other	21.3%

Notes: All figures are percent by weight.

FIGURE 5
NON - RESIDENTIAL SELF - HAUL WASTE
CLARK COUNTY WASTE COMPOSITION STUDY

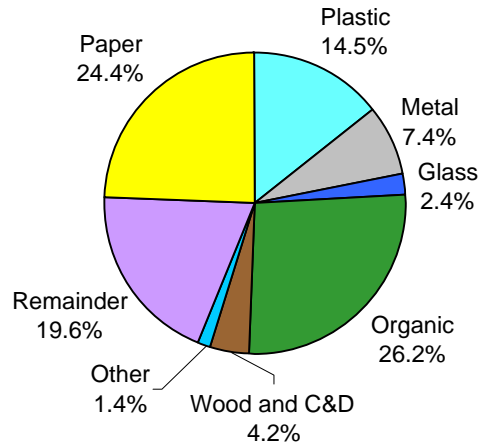


SUMMARY OF WASTE COMPOSITION RESULTS:

PAPER	Newspaper	0.3%	ORGANIC	Food Waste	0.7%
	Cardboard	6.3%		Yard Debris	0.4%
	Mixed Waste Paper	2.1%		Organic Subtotal	1.1%
	Milk Cartons, Other	0.0%	GLASS	Clear Bottles	0.1%
	Non-Recyclable Paper	1.2%		Brown Bottles	0.0%
Paper Subtotal	9.8%	Green Bottles		0.0%	
PLASTIC	PET Bottles	0.2%		Non-Recyclable Glass	1.0%
	HDPE Bottles	0.1%		Glass Subtotal	1.2%
	Bottles 3-7	0.0%	WOOD C&D	Wood	22.2%
	Tubs	0.0%		Gypsum	17.3%
	Plastic Packaging	0.5%		Rubble	2.8%
	Film and Bags	1.3%		Roofing	6.0%
	Other Plastics	6.7%		Carpet, Padding	5.4%
	Expanded Polystyrene	0.3%		Soil, Dirt	0.0%
Plastic Subtotal	8.9%	Wood, C&D Subtotal		53.7%	
METAL	Aluminum Cans	0.1%	OTHER	Hazardous/Special	0.2%
	Tin Cans	0.2%		Household Batteries	0.0%
	Ferrous Metals	5.2%		Animal Excrement	0.0%
	Non-Ferrous Metals	0.2%		E-Waste	0.0%
	Mixed Metals	3.3%		Other Subtotal	0.2%
	Metal Subtotal	9.0%	REMAINDER	Garbage and Other	16.1%

Notes: All figures are percent by weight.

**FIGURE 6
COMMERCIAL WASTE
CLARK COUNTY WASTE COMPOSITION STUDY**

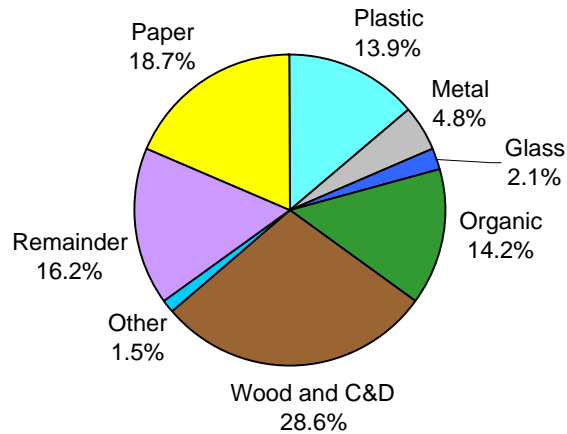


SUMMARY OF WASTE COMPOSITION RESULTS:

PAPER	Newspaper	1.1%	ORGANIC	Food Waste	24.3%
	Cardboard	5.4%		Yard Debris	<u>1.9%</u>
	Mixed Waste Paper	8.3%	GLASS	Organic Subtotal	26.2%
	Milk Cartons, Other	0.4%		Clear Bottles	1.2%
	Non-Recyclable Paper	<u>9.1%</u>		Brown Bottles	0.6%
	Paper Subtotal	24.4%		Green Bottles	0.4%
PLASTIC	PET Bottles	1.0%		Non-Recyclable Glass	<u>0.2%</u>
	HDPE Bottles	0.9%		Glass Subtotal	2.4%
	Bottles 3-7	0.1%	WOOD C&D	Wood	3.0%
	Tubs	0.3%		Gypsum	0.0%
	Plastic Packaging	2.0%		Rubble	0.3%
	Film and Bags	7.2%		Roofing	0.0%
	Other Plastics	2.3%		Carpet, Padding	0.7%
	Expanded Polystyrene	<u>0.8%</u>		Soil, Dirt	<u>0.0%</u>
	Plastic Subtotal	14.5%		Wood, C&D Subtotal	4.2%
METAL	Aluminum Cans	0.4%	OTHER	Hazardous/Special	0.3%
	Tin Cans	1.2%		Household Batteries	0.0%
	Ferrous Metals	3.4%		Animal Excrement	0.5%
	Non-Ferrous Metals	0.2%		E-Waste	<u>0.5%</u>
	Mixed Metals	<u>2.2%</u>		Other Subtotal	1.4%
	Metal Subtotal	7.4%	REMAINDER	Garbage and Other	19.6%

Notes: All figures are percent by weight.

**FIGURE 7
COMMERCIAL COMPACTOR WASTE
CLARK COUNTY WASTE COMPOSITION STUDY**



SUMMARY OF WASTE COMPOSITION RESULTS:

PAPER	Newspaper	0.5%	ORGANIC	Food Waste	12.9%
	Cardboard	7.4%		Yard Debris	1.3%
	Mixed Waste Paper	3.0%		Organic Subtotal	14.2%
	Milk Cartons, Other	0.1%	GLASS	Clear Bottles	0.4%
	Non-Recyclable Paper	7.6%		Brown Bottles	0.2%
PLASTIC	Paper Subtotal	18.7%		Green Bottles	0.2%
	PET Bottles	0.4%		Non-Recyclable Glass	1.4%
	HDPE Bottles	0.3%		Glass Subtotal	2.1%
	Bottles 3-7	0.0%	WOOD C&D	Wood	20.8%
	Tubs	0.1%		Gypsum	1.6%
	Plastic Packaging	1.5%		Rubble	0.3%
	Film and Bags	5.5%		Roofing	3.0%
	Other Plastics	5.4%		Carpet, Padding	2.0%
	Expanded Polystyrene	0.7%		Soil, Dirt	1.0%
	Plastic Subtotal	13.9%		Wood, C&D Subtotal	28.6%
METAL	Aluminum Cans	0.1%	OTHER	Hazardous/Special	0.1%
	Tin Cans	0.3%		Household Batteries	0.0%
	Ferrous Metals	2.7%		Animal Excrement	0.0%
	Non-Ferrous Metals	0.2%		E-Waste	1.3%
	Mixed Metals	1.4%		Other Subtotal	1.5%
	Metal Subtotal	4.8%	REMAINDER	Garbage and Other	16.2%

Notes: All figures are percent by weight.

SECTION III CONCLUSIONS

A. INTRODUCTION

This section examines trends and provides conclusions based on the data collected by this study.

B. WEIGHT OF MATERIALS DISPOSED

The waste quantity and composition results can be combined to show the total weight of disposed materials. Table 4 shows this information for each waste generator, combining the composition data for these generators with their annual waste quantities to calculate the tons of each material that are disposed each year.

C. TRENDS

Data from this study can be compared to previous studies to see how the waste stream has changed in the past 15 years (see Table 5). Since the list of materials examined by the various studies are different, some modifications were necessary in order to compare the results. These modifications include:

- several paper categories needed to be combined, either as “mixed waste paper” or as “all other paper.”
- all categories of plastics had to be combined into one category called “all plastics” because the categories used in the 2003 study were limited and significantly different from other studies.
- several categories for metals had to be combined into a category called “all other metals.”
- categories for wood, C&D and other wastes needed to be combined into broad categories for each of these types of materials.

The bottom row of Table 5 shows the total amount of waste disposed in each year that a waste composition study was performed. For all but this current study, the figures shown are tons per year for the calendar year corresponding to the date of the study. For 2008, the figure shown (281,900 tons) is a mid-year to mid-year figure corresponding to the period of the current study (May 1, 2007 through April 30, 2008). As can be seen, the amount of waste has increased by almost 100,000 tons per year (a 54% increase) in the period from 1993 to 2008. All or most of this increase can probably be directly correlated to increased numbers of residents and employees, but part of the increase may also be the result of increasing generation rates on a per capita and/or per employee basis.

TABLE 4
WEIGHT OF DISPOSED MATERIALS (TONS PER YEAR)
CLARK COUNTY WASTE COMPOSITION STUDY

		Single- <u>Family</u>	Multi- <u>Family</u>	Residential <u>Self-Haul</u>	Non-Res. <u>Self-Haul</u>	<u>Commercial</u>	Commercial <u>Compactors</u>	Totals for <u>Entire County</u>
PAPER	Newspaper	1,140	340	90	110	670	350	2,700
	Cardboard	1,440	670	810	2,410	3,190	4,820	13,350
	Mixed Waste Paper	6,370	1,460	1,040	790	4,890	1,930	16,480
	Milk Cartons, Other	290	40	10	10	240	80	670
	Non-Recyclable Paper	6,290	750	410	440	5,400	4,950	18,250
	Paper Subtotal	15,530	3,270	2,360	3,760	14,400	12,130	51,460
PLASTIC	PET Bottles	1,110	220	120	60	600	250	2,350
	HDPE Bottles	600	170	70	30	550	160	1,590
	Bottles 3-7	140	10	20	0	50	30	250
	Tubs	550	70	30	10	170	70	890
	Plastic Packaging	1,900	270	210	180	1,190	1,000	4,750
	Film and Bags	5,880	680	390	490	4,250	3,550	15,240
	Other Plastics	1,860	350	720	2,550	1,360	3,470	10,320
	Expanded Polystyrene	640	80	90	100	440	450	1,810
	Plastic Subtotal	12,690	1,860	1,650	3,420	8,590	8,980	37,190
METAL	Aluminum Cans	470	110	50	30	230	70	950
	Tin Cans	1,130	210	130	60	730	200	2,460
	Ferrous Metals	1,430	130	510	2,000	1,990	1,750	7,830
	Non-Ferrous Metals	320	40	280	70	130	140	970
	Mixed Metals	1,490	420	1,460	1,270	1,300	930	6,870
	Metal Subtotal	4,840	910	2,430	3,420	4,380	3,100	19,080
ORGANIC	Food Waste	18,740	2,200	1,920	250	14,350	8,360	45,830
	Yard Debris	1,070	240	660	160	1,140	830	4,090
	Organic Subtotal	19,810	2,440	2,580	410	15,490	9,190	49,930
GLASS	Clear Bottles	1,250	430	260	60	720	240	2,950
	Brown Bottles	650	180	140	10	330	120	1,430
	Green Bottles	370	100	50	10	240	100	870
	Non-Recyclable Glass	480	60	650	380	100	920	2,590
	Glass Subtotal	2,750	760	1,100	460	1,390	1,380	7,840
WOOD and C&D	Wood	710	190	2,720	8,490	1,780	13,440	27,330
	Gypsum	100	30	600	6,600	20	1,030	8,370
	Rubble	500	30	450	1,060	210	180	2,420
	Roofing	90	10	140	2,300	20	1,920	4,470
	Carpet, Padding	340	280	810	2,080	440	1,320	5,270
	Soil, Dirt	1,100	30	10	0	0	620	1,770
	Wood, C&D Subtotal	2,850	560	4,730	20,520	2,460	18,500	49,620
OTHER WASTES	Hazardous/Special	320	10	170	70	160	100	830
	Household Batteries	140	20	10	0	20	20	220
	Animal Excrement	2,570	280	520	0	320	0	3,680
	E-Waste	30	10	0	0	300	860	1,210
	Other Subtotal	3,060	320	700	70	810	980	5,930
REMAINDER	Garbage and Other	24,350	4,040	4,220	6,150	11,580	10,500	60,850
	TOTAL	85,880	14,160	19,770	38,210	59,100	64,760	281,900

Note: All figures are tons per year.

TABLE 5
COMPARISON OF RESULTS TO PREVIOUS STUDIES
CLARK COUNTY WASTE COMPOSITION STUDY

		Previous Studies				Current Study,
		<u>1993</u>	<u>1995</u>	<u>1999</u>	<u>2003</u>	<u>2008</u>
PAPER	Newspaper	1.8%	2.0%	2.1%	1.6%	1.0%
	Cardboard	4.7%	5.3%	4.7%	4.0%	4.7%
	Mixed Waste Paper	8.8%	8.0%	6.4%	7.0%	6.1%
	All Other Paper	10.8%	8.0%	8.6%	6.6%	6.5%
	Paper Subtotal	26.1%	23.3%	21.8%	19.2%	18.3%
PLASTIC	All Plastics	10.4%	11.6%	12.9%	11.5%	13.2%
METAL	Aluminum Cans	0.4%	0.4%	0.4%	0.3%	0.3%
	Ferrous Metals	2.1%	2.4%	2.1%	3.1%	2.8%
	Non-Ferrous Metals	0.2%	0.3%	0.2%	0.2%	0.3%
	All Other Metals	3.4%	3.5%	4.5%	3.5%	3.4%
	Metal Subtotal	6.1%	6.6%	7.2%	7.1%	6.8%
ORGANIC	Food Waste	12.1%	11.9%	14.5%	15.3%	16.3%
	Yard Debris	5.8%	4.1%	3.3%	3.8%	1.5%
	Organic Subtotal	17.9%	16.0%	17.8%	19.1%	17.7%
GLASS	Clear Bottles	1.4%	1.4%	1.5%	1.5%	1.1%
	Brown Bottles	0.4%	0.4%	0.7%	0.7%	0.5%
	Green Bottles	0.3%	0.4%	0.4%	0.4%	0.3%
	Non-Recyclable Glass	0.6%	0.5%	0.5%	0.5%	0.9%
	Glass Subtotal	2.7%	2.7%	3.2%	3.2%	2.8%
WOOD, C&D	Wood	10.5%	9.4%	8.5%	10.4%	9.7%
	C&D	8.4%	8.9%	7.4%	7.8%	5.4%
	Wood, C&D Subtotal	18.9%	18.3%	15.9%	18.2%	15.1%
REMAINDER	All Other Wastes	17.9%	21.5%	21.2%	21.7%	26.1%
TOTAL		100.0%	100.0%	100.0%	100.0%	100.0%
TONS PER YEAR DISPOSED		183,210	197,446	227,259	254,019	281,900

Note: All figures are percentages by weight, except the figures for tons per year shown in the bottom row.

D. CONCLUSIONS

Waste Quantities

A number of observations and conclusions can be made by examining the waste quantity data:

- **Residential Self-Haul:** the Residential Self-Haul waste stream is made up of numerous small loads delivered to the transfer stations in cars, pickup trucks and similar vehicles. It is an important service to allow people to haul their own waste to the transfer stations, but this is also the least efficient method of garbage collection. While this source contributes only 7.0% of the county's total waste stream, this type of generator is responsible for 54% of the traffic at the transfer stations (based on transaction records for the period May 1, 2007 through April 30, 2008). Self-haul loads average about 300 pounds per vehicle, compared to an average of 9,000 to 14,000 pounds per load for municipal and private garbage trucks, but frequently take as long or longer to unload as garbage trucks.
- **Non-Residential Self-Haul:** in terms of total tonnages, this type of generator brings in almost twice as much waste as Residential Self-Haul generators (13.6% of the county's waste stream versus 7.0% for Residential Self-Haul), and it does so with fewer trips and larger loads. Based on transaction records for the same period as this study (May 1, 2007 through April 30, 2008), Non-Residential Self-Haul loads represent slightly less than one-quarter (23.3%) of the vehicle trips through the transfer stations and deliver an average of 1,347 pounds per vehicle.
- **Single-Family:** Single-Family wastes contribute almost one-third (30.5%) of the total tonnage of the County's waste stream. This figure does not include Residential Self-Haul quantities, which is also almost entirely from single-family homes.
- **Multi-Family:** this study shows that 14,160 tons per year, or 5.0%, of Clark County's waste stream is from Multi-Family units. Previous studies showed more in 2003 (40,100 tons or 17.2% of the waste stream) and in 1999 (21,400 tons and 9.9%). The current figure appears consistent with other current data, but further study should be done to determine the correct amount of waste generated by multi-family units.
- **Commercial and Commercial Compactors:** the Commercial and Commercial Compactor waste streams together make up almost half (45.0%) of the county's waste stream, with almost equal amounts collected by garbage trucks servicing dumpsters (21.0%) versus single-source roll-off's and compactors (23.0%).

Waste Composition

There are distinct differences in the waste streams disposed by the different types of waste generators, as can be seen in several of the tables and figures in this report (see especially Tables

3 and 4, and Figures 2 through 7). For each of the generators, a few noteworthy conclusions can be drawn:

- **Single-Family:** the largest material in this waste stream is food waste (21.8% by weight), which is disposed at almost three times the quantity as the next largest materials, mixed waste paper (7.4%) and non-recyclable paper (7.3%). There are also significant quantities of film and bags (6.9%) and animal excrement (“kitty litter”) at 3.0%.

The Single-Family waste stream contains 20.9% of the materials currently collected through the curbside recycling program (including yard debris).

- **Multi-Family:** Multi-Family wastes also contain a lot of food waste (15.6%), with again mixed waste paper (10.3%) and non-recyclable paper (5.3%) being the next two highest materials. There are also significant quantities of film and bags (4.8%), cardboard (4.7%), and mixed metals (2.9%).
- **Residential Self-Haul:** self-haul loads from residential sources have more wood, construction debris and metal than other residential sources, and less “regular” household trash (paper, plastic and food waste), reflecting the activities such as remodeling and other special projects that are often the source of self-haul waste. Wood is the material present in the single largest quantity, at 13.8%, followed by food waste (9.7%), mixed metals (7.4%), mixed waste paper (5.2%), cardboard (4.1%), and other plastics (3.7%).
- **Non-Residential Self-Haul:** like self-haul waste from residential sources, Non-Residential Self-Haul loads are often the result of construction activities or other special projects. The large amount of wood (22.2%) and other construction waste (31.5%) clearly shows the influence of construction activities on this waste stream. Although this waste generator contributes only 13.6% of the County’s total waste stream, Non-Residential Self-Haul customers are disposing of 31% of the wood and 54% of the C&D materials.
- **Commercial:** waste from this source also contains a large amount of food waste (24.3%), followed by non-recyclable paper (9.1%), mixed waste paper (8.3%), plastic film and bags (7.2%), and cardboard (5.4%).
- **Commercial Compactors:** waste from this source contains less food waste (12.9%) than the other commercial category. Wood is the largest category (20.8%), followed by cardboard (7.4%), non-recyclable paper (7.6%), plastic film and bags (5.5%), and other plastics (5.4%).

GLOSSARY

GLOSSARY

INTRODUCTION

This document defines the types of generators and waste sorting categories used for the 2007-2008 Clark County Waste Stream Analysis.

A. GENERATOR CATEGORIES

Single-Family: waste originating from single-family homes and mobile home parks. To be counted in this category, the waste must have been delivered to the landfill by a municipal collection crew or a private garbage hauler.

Multi-Family: wastes collected from apartment buildings. To be counted in this category, the waste must have been delivered to the landfill by a municipal collection crew or a private garbage hauler.

Residential Self-Haul: residential waste delivered to the landfill by a homeowner, renter or landlord, typically using cars, vans, jeeps, pickup trucks, rented trucks and trailers.

Non-Residential Self-Haul: non-residential waste delivered to the landfill by the same company that generated the waste, including construction and demolition waste brought in by contractors.

General Commercial: waste from businesses, industries and institutions, delivered by a municipal collection crew or private garbage hauler, but not including single-source containers such as stationary compactors and roll-off's.

Commercial Compactors: waste from businesses, industries and institutions, delivered by a municipal collection crew or private garbage hauler in a stationary compactor or roll-off.

B. WASTE SORTING CATEGORIES

PAPER

Newspaper: printed groundwood newsprint, including glossy ads and Sunday edition magazines that are delivered with the newspaper (unless these are found separately during sorting).

Cardboard: unwaxed kraft paper corrugated containers and boxes, unless poly- or foil-laminated, and including brown paper bags.

Mixed Waste Paper (MWP): low and high grades of paper, including office/computer paper and magazines. Also including colored papers, notebook or other lined paper, envelopes with plastic windows, non-corrugated paperboard, carbonless copy paper, egg cartons, paperback books, other groundwood products, frozen food packaging, and junk mail.

Milk Cartons and Other Aseptic Containers: milk cartons and similar gable-top containers (such as orange juice cartons), and juice drink boxes.

Non-Recyclable Paper: contaminated papers and non-recyclable types of papers such as carbon paper, tissues, paper towels, paper plates, waxed papers, frozen food containers, paper packaging with metal or plastic parts, and hardcover books.

PLASTIC

PET Bottles: polyethylene terephthalate (PET) bottles, with or without base cups, including soda, oil, liquor and other types of bottles. The SPI code for PET is 1.

HDPE Bottles: clear and colored high density polyethylene (HDPE) milk, juice, detergent, and other bottles. Note that this category does not include motor oil bottles. The SPI code for HDPE is 2.

Tubs: plastic containers of all resin types that are as wide or wider at the top than at the bottom.

Bottles Types 3 - 7: all bottles that are not PET or HDPE, where the neck of the container is narrower than the body. Includes SPI codes 3 - 7.

Plastic Packaging: all other plastic packaging (besides tubs, bottles, film and bags), and shipping materials and other plastic items which are not themselves finished consumer products, including thermoplastics and thermosetting plastics used for packaging. Also include HDPE motor oil bottles.

Film and Bags: all plastic packaging films and bags. To be counted in this category, the material must be flexible (i.e., can be bent without making a noise) and relatively clean (recoverable).

Other Plastics: finished plastic products such as toys, toothbrushes, vinyl hose and shower curtains.

Expanded Polystyrene: packaging and finished products made of expanded polystyrene. The SPI code for polystyrene (PS) is 6.

METAL

Aluminum Cans: aluminum beverage cans.

Steel Cans: tin-coated steel food containers. This category includes bi-metal beverage cans, but not paint cans or other types of cans.

Ferrous Metals: products and pieces made from metal to which a magnet adheres (but including stainless steel), and which are not significantly contaminated with other metals or materials (in the latter case, the item should be included instead under “mixed metals/materials”). This category includes paint cans, aerosol cans (empty cans only, partially-full cans will be characterized by the contents), and other non-food cans.

Non-Ferrous Metals: metallic products and pieces not derived from iron (i.e., to which a magnet does not adhere) and which were not significantly contaminated with other metals or materials. Includes aluminum foil and pans, and aluminum cat food and other cans.

Mixed Metals/Materials: small appliances, motors, insulated wire and finished products containing a mixture of metals and/or other materials, but which are greater than 50% metal. Also includes electronics that are not included in the e-waste category.

ORGANICS

Food Waste: food waste and scraps, including bones, rinds, etc., and including the food container when the container weight was not appreciable compared to the food inside.

Yard and Garden: grass clippings, leaves and weeds, and prunings four inches or less in diameter.

GLASS

Clear, Green and Brown Glass Containers: these are three separate categories for bottles and jars that are clear, green or brown in color. Blue glass containers should be included with non-recyclable glass.

Non-Recyclable Glass: window glass, light bulbs, glassware, mirrors, and other glass that is not recyclable. Does not include ceramics.

WOOD AND C&D WASTES

Wood: all treated and untreated wood that is not significantly contaminated with other materials, including stumps (if there is not much soil adhering to it) and logs.

Gypsum Board: used or new gypsum wallboard, sheetrock or drywall present in recoverable amounts or pieces (generally any piece larger than two inches square was recovered from the sample).

Rubble: rock, gravel, cement, concrete blocks, bricks, ceramics, porcelain, and similar materials.

Roofing Waste: asphalt and fiberglass shingles, tarpaper, and similar wastes from demolition or installation of roofs. Does not include cedar shingle or shakes (see wood subcategory).

Carpeting and Padding: pieces of carpeting, as well as foam rubber and other materials used as padding under carpets.

Soil, Dirt, and Non-Distinct Fines: this category includes soil, sand, dirt and similar materials, where these could be recovered separately from the sample.

OTHER WASTES

Hazardous Wastes: hazardous wastes of all types, including oil filters and household batteries (weigh separately).

Animal Excrement: kitty litter and other animal wastes.

E-Wastes: electronic wastes as defined by Washington's State's upcoming rules, including computers (base units and monitors), televisions, and laptops.

REMAINDER

Garbage and Other: all other wastes that do not fit into the above categories, including clothing, diapers, various types of construction debris and contaminated wood, rubber products, cosmetics, etc.

APPENDIX A

STATISTICAL CERTAINTY OF RESULTS

APPENDIX A STATISTICAL CERTAINTY OF RESULTS

A. INTRODUCTION

There is a quantifiable degree of error associated with the waste composition results shown in this report, and this error can be expressed as confidence intervals. This appendix shows the confidence intervals associated with the waste composition results.

B. METHODOLOGY

This waste composition study was designed to provide accurate data on the amount and composition of wastes from several sources. As with all sampling projects and/or surveys, however, there is a definable amount of potential error in the results. There is also a critical need to follow standard and unbiased procedures in order to achieve results that are truly representative. This project used standard procedures for choosing and sorting samples of waste, and an important aspect of choosing the samples was random selection.

The best approach for collecting waste composition data in this type of study is a “stratified sampling,” where the waste stream is divided into categories (in this case, divided by generator types) and sampling is performed within each of the categories. Sampling within each category (or generator type) must be randomly conducted in order to characterize the waste without bias. This was done by pre-identifying loads to be sampled, using a tool that allowed vehicles of each type to be noted as the vehicles arrived, and then vehicles that had been pre-selected were sampled. For instance, if two samples of commercial waste were targeted for a certain day of fieldwork, then the sampling form might have identified the second and tenth loads as the ones to be sampled. Loads of commercial wastes would then be checked off as those arrived at the facility, and when the second and tenth loads arrived those would then be sampled.

Before a load is actually selected for sampling, the driver of the vehicle was interviewed to determine if it had any unusual characteristics. If it was discovered that the load originated from outside of Clark County or if it presented some other anomaly, then it was rejected and the next load of that type was sampled instead.

For loads that are chosen for sampling, a sample identification number was assigned, basic information about the load was recorded in the upper section of a sample data form, and any additional comments about the source or characteristics of the load were recorded at the bottom of the form. If small, the load was dumped near the sorting area (this was generally the case with residential self-haul loads). Large loads were emptied in the usual area, away from the sorting area, and then sampled using a loader. The location of the “sub-sample” taken in this way from a large load was also determined randomly through a list of pre-selected numbers and an imagined grid pattern. Once taken, each sub-sample was visually examined to ensure that it was large enough, since a minimum sample weight of 200 to 250 pounds was necessary to ensure the statistical validity of the results. This sample weight has been demonstrated by previous studies to be necessary for accurately characterizing the waste stream.

For this type of study, the statistical certainty of the results can be expressed using confidence intervals. Confidence intervals are the range of values for which one can be confident (to a given degree, such as 90% confident) that the true value falls within. The confidence limits are also sometimes shown as a

“plus or minus value.” For example, this study shows that the potential amount of newspaper in the Single-Family waste stream is 1.33% +/- 0.44%. This is based on a confidence interval of 90%, so that in this example one can be 90% confident that the true value for newspaper falls between 0.89% and 1.77%.

The calculation of confidence intervals for this study is complicated slightly by the use of weighted averages. The calculation of confidence intervals for weighted averages begins with calculating standard deviations for each material for each generator and for each quarter. The standard deviation is then converted to the standard error of the mean (SEM) by dividing the standard deviation by the square root of the number of samples. Once the SEM has been determined for each material, each quarter and each waste generator, it can be manipulated in the same way as the average composition figures by using weighted averages as appropriate for the data being combined. The final SEM's can be multiplied by a factor of 1.64 and then added or subtracted from the average composition values to derive the upper and lower confidence limits, respectively. The factor of 1.64 is based on the choice of a 90% confidence interval.

C. RESULTS

Table A-1 shows the confidence limits associated with the composition results for each generator and for the entire County.

**TABLE A - 1
CONFIDENCE LIMITS BY TYPE OF GENERATOR
CLARK COUNTY WASTE COMPOSITION STUDY**

		Single-Family			Multi-Family			Residential Self-Haul			Non-Residential Self-Haul		
		Average	LCL	UCL	Average	LCL	UCL	Average	LCL	UCL	Average	LCL	UCL
PAPER	Newspaper	1.33%	0.89%	1.77%	2.44%	0.88%	3.99%	0.44%	0.07%	0.81%	0.28%	0.00%	0.63%
	Cardboard	1.68%	0.89%	2.46%	4.74%	2.83%	6.65%	4.11%	1.41%	6.80%	6.31%	2.28%	10.34%
	Mixed Waste Paper	7.42%	5.79%	9.05%	10.34%	6.85%	13.84%	5.24%	1.63%	8.86%	2.06%	0.08%	4.04%
	Milk Cartons, Other	0.34%	0.24%	0.43%	0.26%	0.17%	0.36%	0.06%	0.00%	0.13%	0.03%	0.00%	0.08%
	Non-Recyclable Paper	7.32%	6.28%	8.36%	5.32%	4.11%	6.54%	2.10%	1.09%	3.11%	1.16%	0.12%	2.20%
	Paper Subtotal	18.08%	16.06%	20.11%	23.11%	18.12%	28.09%	11.95%	6.40%	17.50%	9.84%	4.00%	15.68%
PLASTIC	PET Bottles	1.29%	0.96%	1.63%	1.54%	1.10%	1.97%	0.61%	0.16%	1.06%	0.16%	0.02%	0.29%
	HDPE Bottles	0.70%	0.48%	0.91%	1.21%	0.77%	1.66%	0.37%	0.10%	0.64%	0.08%	0.00%	0.19%
	Bottles 3-7	0.17%	0.09%	0.24%	0.07%	0.01%	0.13%	0.09%	0.02%	0.16%	0.01%	0.00%	0.03%
	Tubs	0.64%	0.45%	0.84%	0.48%	0.32%	0.65%	0.14%	0.05%	0.23%	0.01%	0.00%	0.03%
	Plastic Packaging	2.22%	1.78%	2.65%	1.90%	1.23%	2.58%	1.07%	0.48%	1.66%	0.46%	0.09%	0.83%
	Film and Bags	6.85%	5.98%	7.71%	4.83%	3.99%	5.68%	1.99%	0.93%	3.04%	1.27%	0.63%	1.92%
	Other Plastics	2.16%	1.33%	2.99%	2.50%	1.09%	3.91%	3.66%	1.86%	5.46%	6.68%	0.00%	14.74%
	Expanded Polystyrene	0.75%	0.58%	0.92%	0.58%	0.45%	0.72%	0.45%	0.08%	0.82%	0.26%	0.00%	0.53%
	Plastic Subtotal	14.77%	13.41%	16.14%	13.12%	10.95%	15.29%	8.36%	5.66%	11.06%	8.95%	0.51%	17.39%
METAL	Aluminum Cans	0.54%	0.39%	0.70%	0.80%	0.59%	1.01%	0.23%	0.07%	0.40%	0.07%	0.01%	0.13%
	Tin Cans	1.31%	0.94%	1.68%	1.49%	1.12%	1.86%	0.68%	0.08%	1.29%	0.16%	0.00%	0.40%
	Ferrous Metals	1.67%	0.72%	2.62%	0.95%	0.32%	1.59%	2.60%	0.08%	5.13%	5.22%	0.62%	9.82%
	Non-Ferrous Metals	0.37%	0.23%	0.51%	0.25%	0.17%	0.33%	1.39%	0.00%	3.17%	0.18%	0.00%	0.40%
	Mixed Metals	1.74%	0.40%	3.08%	2.93%	1.14%	4.72%	7.38%	1.78%	12.98%	3.32%	0.00%	6.99%
	Metal Subtotal	5.64%	3.66%	7.62%	6.43%	4.42%	8.44%	12.29%	5.40%	19.19%	8.95%	2.67%	15.23%
ORGANIC	Food Waste	21.82%	18.75%	24.89%	15.57%	11.65%	19.48%	9.72%	3.09%	16.36%	0.67%	0.00%	1.51%
	Yard Debris	1.25%	0.32%	2.17%	1.67%	0.00%	3.39%	3.32%	0.00%	7.22%	0.41%	0.00%	1.03%
	Organic Subtotal	23.07%	19.94%	26.20%	17.24%	13.50%	20.97%	13.05%	5.98%	20.12%	1.08%	0.00%	2.46%
GLASS	Clear Bottles	1.45%	1.06%	1.85%	3.01%	2.06%	3.96%	1.33%	0.33%	2.33%	0.14%	0.00%	0.33%
	Brown Bottles	0.76%	0.35%	1.17%	1.24%	0.65%	1.82%	0.72%	0.00%	1.52%	0.04%	0.00%	0.09%
	Green Bottles	0.43%	0.13%	0.74%	0.68%	0.15%	1.21%	0.23%	0.00%	0.56%	0.02%	0.00%	0.06%
	Non-Recyclable Glass	0.56%	0.22%	0.90%	0.41%	0.06%	0.77%	3.28%	0.00%	7.50%	1.00%	0.00%	2.47%
	Glass Subtotal	3.21%	2.28%	4.13%	5.34%	3.91%	6.78%	5.56%	0.35%	10.76%	1.21%	0.00%	2.71%
WOOD and C&D	Wood	0.83%	0.34%	1.32%	1.33%	0.07%	2.59%	13.75%	5.62%	21.87%	22.21%	8.33%	36.09%
	Gypsum	0.11%	0.00%	0.29%	0.20%	0.00%	0.50%	3.05%	0.00%	6.32%	17.26%	2.53%	31.99%
	Rubble	0.58%	0.17%	1.00%	0.18%	0.00%	0.40%	2.28%	0.00%	5.06%	2.77%	0.00%	6.59%
	Roofing	0.10%	0.00%	0.26%	0.05%	0.00%	0.12%	0.70%	0.00%	1.73%	6.01%	0.00%	13.30%
	Carpet, Padding	0.40%	0.00%	0.88%	1.95%	0.00%	4.77%	4.08%	0.00%	9.56%	5.45%	0.00%	12.71%
	Soil, Dirt	1.28%	0.00%	3.04%	0.23%	0.00%	0.46%	0.07%	0.00%	0.18%	0.01%	0.00%	0.03%
	Wood, C&D Subt.	3.31%	0.55%	6.08%	3.93%	0.00%	7.91%	23.92%	11.00%	36.83%	53.70%	35.13%	72.27%
	Other Subtotal	3.56%	2.38%	4.75%	2.27%	0.84%	3.69%	3.54%	0.54%	6.53%	0.18%	0.00%	0.40%
RESIDUES	Garbage	28.36%	24.13%	32.59%	28.57%	23.30%	33.83%	21.34%	11.26%	31.42%	16.10%	4.71%	27.48%

Notes:

LCL = Lower Confidence Limit for 90% confidence interval.

UCL = Upper Confidence Limit for 90% confidence interval.

All figures are percentages by weight.

TABLE A-1, continued
CONFIDENCE LIMITS BY TYPE OF GENERATOR
CLARK COUNTY WASTE COMPOSITION STUDY

		Commercial			Commercial Compactor			Annual Average for Entire Count		
		Average	LCL	UCL	Average	LCL	UCL	Average	LCL	UCL
PAPER	Newspaper	1.14%	0.42%	1.86%	0.54%	0.03%	1.05%	0.96%	0.41%	1.51%
	Cardboard	5.40%	3.52%	7.29%	7.44%	1.96%	12.93%	4.74%	2.01%	7.46%
	Mixed Waste Paper	8.28%	5.90%	10.66%	2.98%	1.33%	4.62%	5.85%	3.78%	7.92%
	Milk Cartons, Other	0.41%	0.18%	0.64%	0.13%	0.00%	0.25%	0.24%	0.12%	0.36%
	Non-Recyclable Paper	9.14%	7.25%	11.04%	7.64%	3.05%	12.23%	6.47%	4.43%	8.51%
	Paper Subtotal	24.37%	20.52%	28.21%	18.73%	10.51%	26.95%	18.25%	13.51%	23.00%
PLASTIC	PET Bottles	1.01%	0.71%	1.31%	0.38%	0.11%	0.65%	0.83%	0.54%	1.13%
	HDPE Bottles	0.93%	0.57%	1.29%	0.25%	0.06%	0.44%	0.56%	0.32%	0.80%
	Bottles 3-7	0.08%	0.03%	0.14%	0.04%	0.00%	0.09%	0.09%	0.03%	0.14%
	Tubs	0.28%	0.17%	0.40%	0.10%	0.02%	0.19%	0.31%	0.19%	0.44%
	Plastic Packaging	2.01%	1.33%	2.68%	1.55%	0.68%	2.42%	1.68%	1.09%	2.28%
	Film and Bags	7.18%	5.56%	8.81%	5.48%	2.00%	8.96%	5.40%	3.80%	7.01%
	Other Plastics	2.29%	1.02%	3.57%	5.36%	1.50%	9.22%	3.66%	0.96%	6.36%
	Expanded Polystyrene	0.75%	0.44%	1.06%	0.70%	0.06%	1.35%	0.64%	0.31%	0.98%
	Plastic Subtotal	14.54%	12.08%	17.00%	13.86%	7.20%	20.52%	13.19%	9.29%	17.09%
METAL	Aluminum Cans	0.38%	0.26%	0.51%	0.11%	0.04%	0.18%	0.34%	0.22%	0.46%
	Tin Cans	1.24%	0.73%	1.74%	0.30%	0.04%	0.57%	0.87%	0.50%	1.25%
	Ferrous Metals	3.37%	0.53%	6.21%	2.71%	0.80%	4.61%	2.78%	0.62%	4.93%
	Non-Ferrous Metals	0.22%	0.12%	0.33%	0.22%	0.02%	0.41%	0.34%	0.08%	0.61%
	Mixed Metals	2.20%	0.24%	4.16%	1.44%	0.00%	3.25%	2.44%	0.22%	4.65%
	Metal Subtotal	7.41%	3.74%	11.08%	4.78%	1.98%	7.58%	6.77%	3.32%	10.22%
ORGANIC	Food Waste	24.28%	16.95%	31.62%	12.91%	4.31%	21.51%	16.26%	11.03%	21.48%
	Yard Debris	1.93%	0.09%	3.76%	1.29%	0.00%	3.01%	1.45%	0.00%	2.96%
	Organic Subtotal	26.21%	19.14%	33.28%	14.20%	5.03%	23.36%	17.71%	12.30%	23.12%
GLASS	Clear Bottles	1.21%	0.82%	1.60%	0.37%	0.05%	0.70%	1.05%	0.63%	1.46%
	Brown Bottles	0.56%	0.18%	0.93%	0.18%	0.00%	0.42%	0.51%	0.16%	0.86%
	Green Bottles	0.41%	0.01%	0.81%	0.16%	0.00%	0.32%	0.31%	0.04%	0.58%
	Non-Recyclable Glass	0.17%	0.00%	0.35%	1.42%	0.00%	3.32%	0.92%	0.00%	2.01%
	Glass Subtotal	2.35%	1.49%	3.21%	2.13%	0.00%	4.46%	2.78%	1.15%	4.42%
WOOD and C&D	Wood	3.01%	0.97%	5.04%	20.76%	8.77%	32.75%	9.69%	3.85%	15.54%
	Gypsum	0.03%	0.00%	0.08%	1.59%	0.00%	3.86%	2.97%	0.14%	5.80%
	Rubble	0.35%	0.03%	0.66%	0.28%	0.00%	0.64%	0.86%	0.00%	1.86%
	Roofing	0.04%	0.00%	0.09%	2.96%	0.00%	6.27%	1.59%	0.00%	3.47%
	Carpet, Padding	0.74%	0.00%	1.58%	2.04%	0.00%	4.98%	1.87%	0.00%	4.38%
	Soil, Dirt	0.00%	0.00%	0.00%	0.95%	0.00%	2.30%	0.63%	0.00%	1.49%
	Wood, C&D Subt.	4.16%	1.55%	6.77%	28.57%	13.23%	43.91%	17.60%	9.07%	26.14%
OTHER WASTES	Hazardous/Special	0.28%	0.00%	0.61%	0.15%	0.00%	0.34%	0.29%	0.00%	0.60%
	Household Batteries	0.04%	0.01%	0.08%	0.03%	0.00%	0.06%	0.08%	0.02%	0.13%
	Animal Excrement	0.54%	0.01%	1.06%	0.00%	0.00%	0.00%	1.31%	0.42%	2.19%
	E-Waste	0.52%	0.00%	1.12%	1.33%	0.00%	3.44%	0.43%	0.00%	1.06%
	Other Subtotal	1.37%	0.33%	2.40%	1.51%	0.00%	3.73%	2.10%	0.70%	3.51%
RESIDUES	Garbage	19.59%	14.98%	24.21%	16.21%	6.85%	25.57%	21.58%	14.66%	28.51%

Notes:

LCL = Lower Confidence Limit for 90% confidence interval.

UCL = Upper Confidence Limit for 90% confidence interval.

All figures are percentages by weight.